PRICE&MYERS
Consulting Engineers

8 Elsworthy Road
NW3

20261

June 2011

Structural Engineering
Planning Report

Contents

1 Existing site conditions

1.1 The site

The property at 8 Elsworthy Road is a late 19th Century, 3 story semi-detatched house of traditional timber floor, masonry wall construction. The site slopes to the rear, the back garden being approximately 1m lower than the front garden. The road sits just north of Primrose Hill. Beneath the part of the back garden is the Network Rail Primrose Hill (Fast Lines) Tunnel.

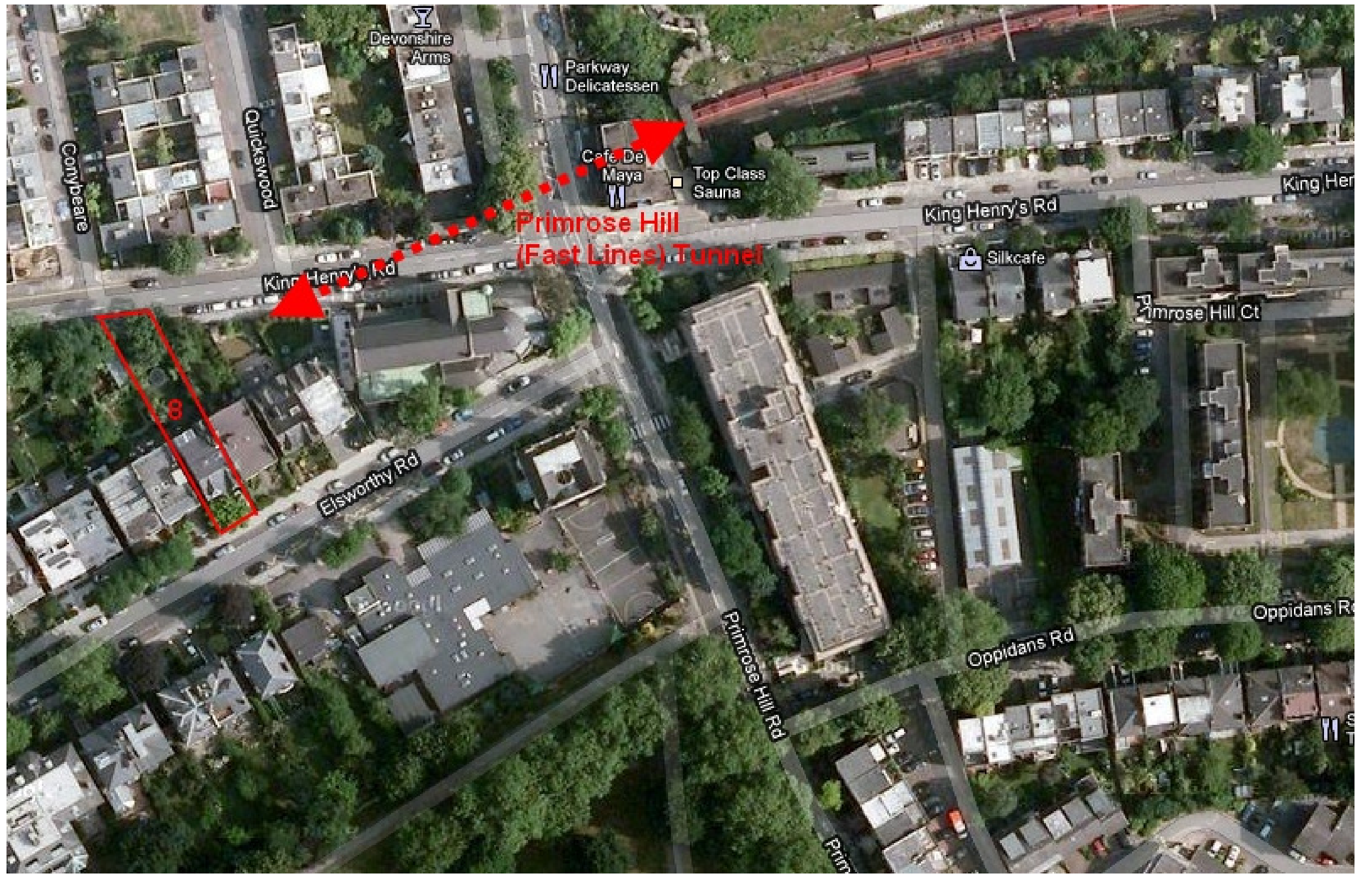


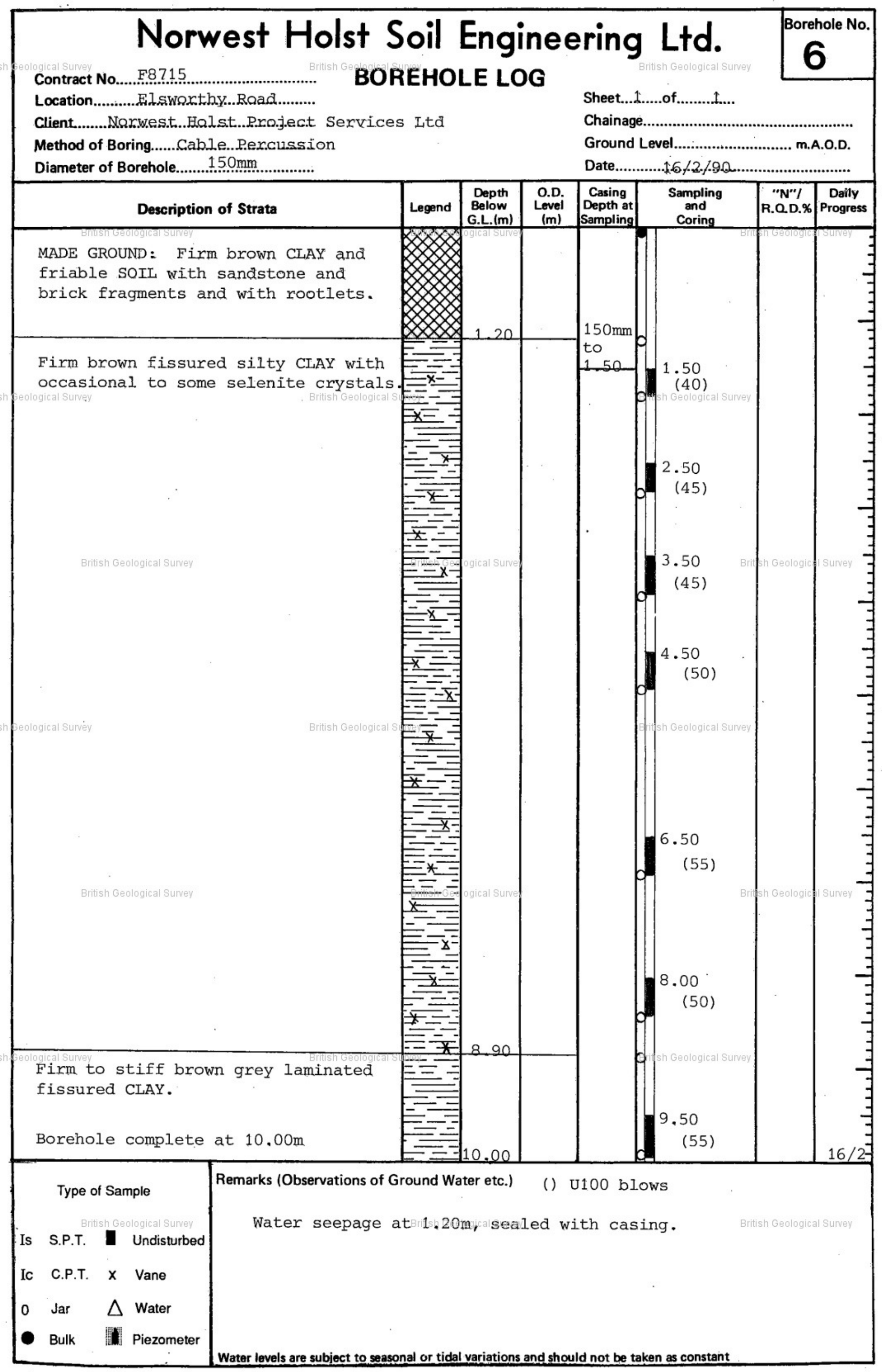
Figure 1: Site photo

1.2 Scheme Overview

The scheme involves the formation of a small basement beneath the house and part of the garden as well as a small rear extension at ground level. Due to the level difference from front to back of house the basement will effectively sit out of the ground by 1m in the rear garden, limiting excavation.

1.3 Ground conditions

A full site investigation has not yet been carried out on the site. However from historic borehole records from the British Geological Survey and geological maps we can extrapolate the expected ground profile. An extract from historical geological records is shown in Figure 2 the geological map is shown in Figure 3.



Norwest Holst Soil Engineering Ltd.

BOREHOLE LOG

Borehole No. 6

Contract No. F8715
Location Elsworthy Road
Client Norwest Holst Project Services Ltd
Method of Boring Cable Percussion
Diameter of Borehole 150mm

Sheet 1 of 1
Chainage
Ground Level m.A.O.D.
Date 16/2/90

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
MADE GROUND: Firm brown CLAY and friable SOIL with sandstone and brick fragments and with rootlets.		1.20		150mm to 1.50			
Firm brown fissured silty CLAY with occasional to some selenite crystals.		8.90			1.50 (40) 2.50 (45) 3.50 (45) 4.50 (50) 6.50 (55) 8.00 (50)		
Firm to stiff brown grey laminated fissured CLAY. Borehole complete at 10.00m		10.00			9.50 (55)		16/2

Type of Sample: Is S.P.T. ▮ Undisturbed; Ic C.P.T. x Vane; o Jar △ Water; ● Bulk ▯ Piezometer

Remarks (Observations of Ground Water etc.) () U100 blows

Water seepage at 1.20m, sealed with casing.

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Figure 2 Local Historic Borehole Record

1.3.1 Made Ground

Made Ground is expected for depths between 0.5 and 3m based on historic local borehole records. As the current building steps from front to back and has a large void / cellar space beneath it is hard to judge the actual level of made ground that will be encountered.

1.3.2 London Clay is expected to underlie the Made Ground with a strata thickness of 30 – 40m. We expect the London Clay to be the main load-bearing strata on which the building will be founded.

1.3.3 Groundwater is not expected. Some small deposits will be perched on top of the London Clay.

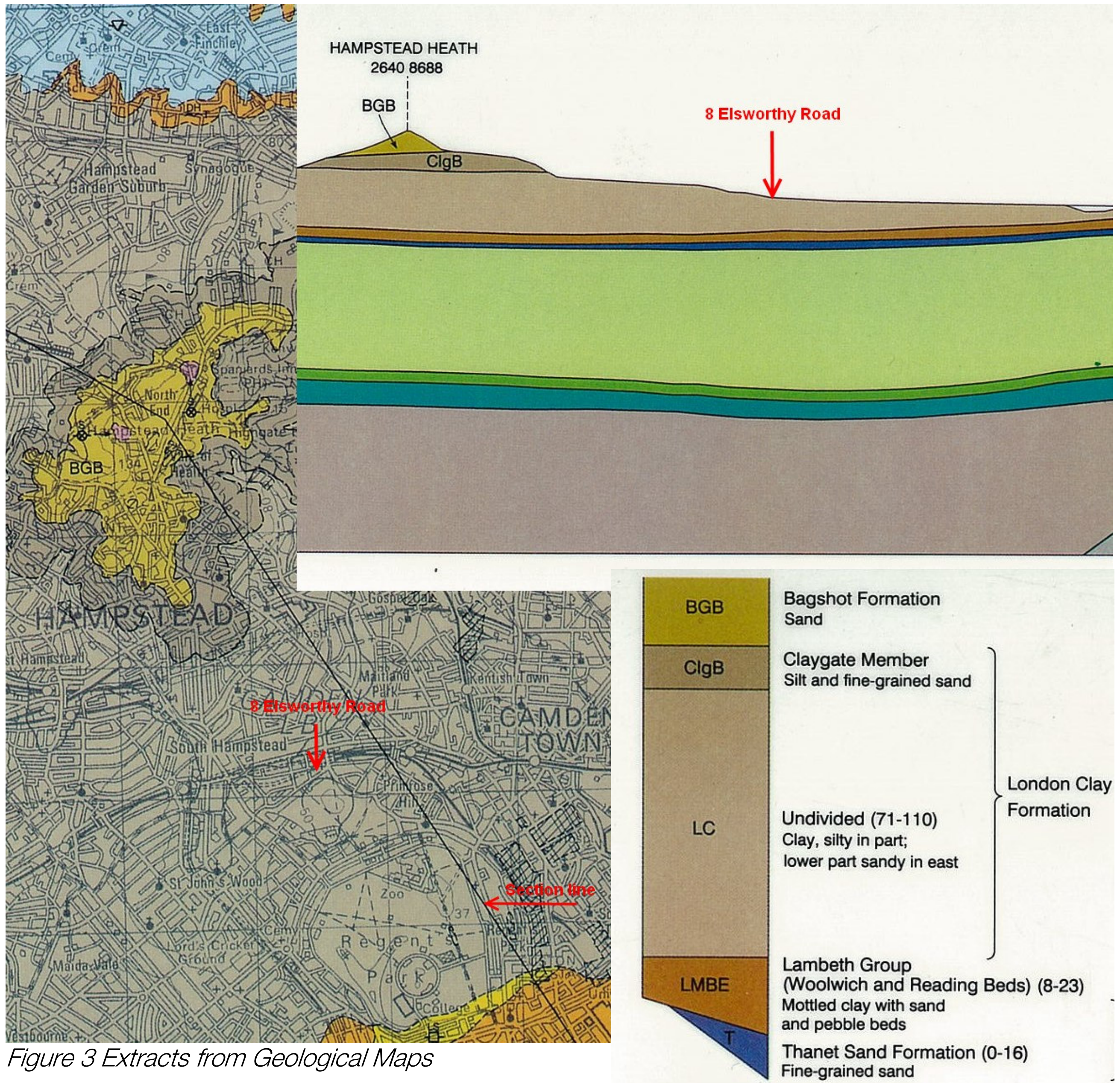


Figure 3 Extracts from Geological Maps

1.4 Soil Contamination

Soil contamination is a very site specific issue mostly related to past use and it is difficult to predict what contamination there might be without a full desk study. However, it is believed that the present house was the first structure on the site that was previously occupied by the Eton and Middlesex Cricket Ground, as such contamination of the site seems unlikely.

1.5 Unexploded Ordnance

From a desk study of the London Bomb Damage Maps we can see that the sight is not recorded as being damaged during WW2. As the house on this site predates WW2 and the modest extent of the proposed scheme we consider there to be a very low risk of unexploded ordnance on this site.

Figure 4 : Extract from London Bomb Damage Maps, site marked in red

2 Building Structure

2.1 Structural Design Philosophy

The basement will be built by excavating the existing undercroft / cellar area by approximately another 1.5m. The Party and Boundary walls will be underpinned, either conventionally with Mass concrete and a reinforced concrete lining wall built in front, or by use of reinforced concrete underpins.

A concrete basement slab will be cast that will be thickened locally to create new strip footings beneath load bearing wall lines.

To the rear a new concrete slab will be cast at ground floor level to create the roof to the basement where it steps up from within the footprint of the house.

2.2 Basement Construction

The current proposal is to underpin the Party and Boundary walls with either traditional mass concrete underpins and a reinforced concrete lining wall or with reinforced concrete underpins.

2.2.1 Traditional Mass Concrete Underpins.

To form these the ground level is first reduced to the bottom of footing depth. In a short section hit and miss sequence, the ground will be then be excavated to the full depth of the basement beneath the footing and a mass concrete underpin cast. As soon as this has cured the underpin will be dry packed hard to the underside of the footing. This will be repeated non-sequentially until the walls of the basement are formed. The underpins will remained propped until a reinforced concrete lining wall can be cast in front of the underpins to withstand the lateral earth pressure.

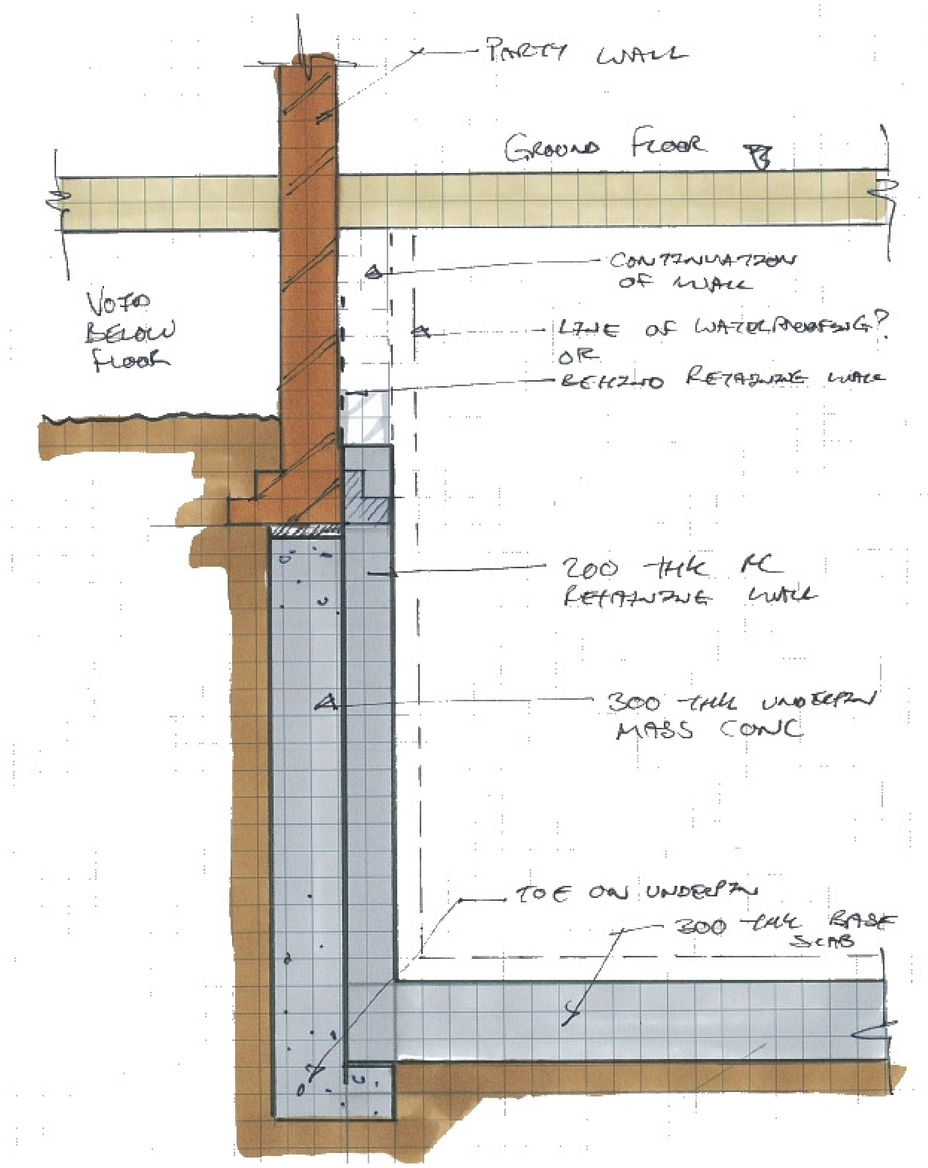


Figure 5 Traditional Underpin

2.2.2 Reinforced Concrete Underpins

Very similar in construction to traditional concrete underpins, reinforced concrete underpins differ in that the concrete beneath the footings is reinforced so that it is able to resist the lateral pressures, therefore removing the need for a separate lining wall.

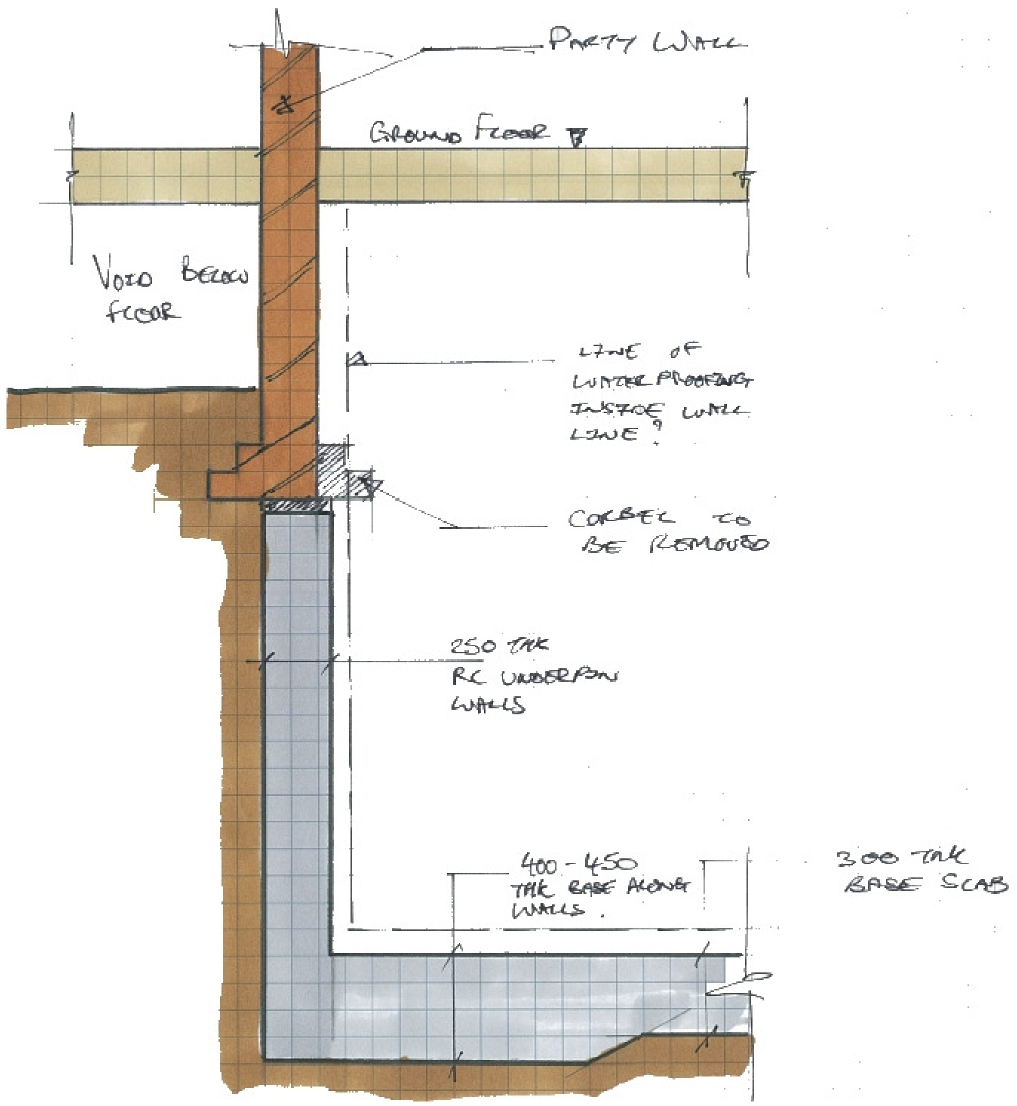


Figure 6 RC Underpin

2.2.3 Basement Boundary Wall construction

For the part of the basement projecting into the garden, the perimeter walls are intended to be built in a similar manner to those described above. Either the boundary walls will be removed and reinforced concrete walls built in non-sequential short sections as an underpin, or the boundary walls will be retained and underpinned and a reinforced concrete lining wall will be built in front.

2.2.4 Ground Floor Enclosing Basement

Beneath the house the existing timber ground floor will provide the cover to the basement. To the rear where the basement extends in to the garden a new concrete slab will be cast at the level of the ground floor. This slab will support the new terrace over as well as providing a prop to the basement walls.

2.2.5 Grade of Basement

It is assumed that as the basement is inhabited the basement will be built to a minimum of Class 3 to BS 8102:2009 (see following table for an extract of the Standard). As discussed above, the basement walls will probably be formed from underpins or the existing walls retained.

Table 1: Guide of level of protection to suit basement use (from BS 8102:2009)

Grade	Basement usage	Performance level
1	Car parking; plant rooms (excluding electrical equipment); workshops	Some seepage and damp areas tolerable, dependant on the intended use. Local drainage might be necessary to deal with seepage.
2	Workshops and plant rooms requiring drier environment (than Grade 1); storage areas	No water penetration acceptable. Damp areas tolerable; ventilation might be required
3	Ventilated residential and commercial areas including offices, restaurants etc., leisure centres	No water penetration acceptable. Ventilation, dehumidification or air conditioning necessary, appropriate to intended use.

2.3 Foundation options

Foundations for this scheme will effectively be simple strip footings. In reality these will take the form of local strip thickenings within the basement slab, stiffening the slab and ensuring load transfer to the London Clay bearing strata beneath.

2.4 Monitoring during Construction

2.4.1 Monitoring Buildings

During the construction of the basement, monitoring points can be set up to record any variable movements between properties. By using a system of targets on 8 Elsworthy Road and its neighbours, monitored and logged at regular intervals, any differential movements can be identified and the construction method and sequence altered accordingly to limit movements.

2.4.2 Monitoring Water Levels

The water table is not expected to be encountered during the construction of this basement, therefore monitoring is not expected to be required. Historic geological records for the area indicate small seepages of water perched above the London Clay.

2.5 Network Rail – Primrose Hill (Fast lines) Tunnel

The Network Rail Primrose Hill (Fast Lines) Tunnel runs beneath part of the garden. The crown of the tunnel is approximately 8m below ground level and the tunnel is approximately 10m wide. After correspondence with Network Rail the extent of the basement has been revised to fall outside the 10m zone of influence measured from the crown of the tunnel. The rear wall of the basement will be formed in a sectional underpin sequence so that Network Rail have accepted that the proposed scheme should not impact on their tunnel.

3 Design Criteria

3.1 Loading

Imposed loading (to BS 6399:part 1)

Domestic areas	= 1.5 kN/m^2
External areas	= 3.0 kN/m^2
Roof (flat with access)	= 0.75 kN/m^2
Roof (pitched)	= 0.6 kN/m^2

Wind loading (to BS 6399:part 2)

4 Sustainability

4.1 Materials

4.1.1 Reinforced concrete

Concrete in a typical commercial building can contribute up to 45% of the total environmental impact of the structure and about 50% of this is due to the cement content of the concrete. To produce 1 tonne of traditional Portland cement approximately 1.6 tonnes of quarry materials are used and around 1 tonne of CO2 produced. In contrast, however, nearly all reinforcement used in the UK comes from a recycled source.

There are two things that can be done to reduce the environmental impact of concrete as a material: the use of recycled or secondary aggregates, and the reduction of Portland cement usage.

4.1.2 Recycled or secondary aggregates

Recycled aggregates: derived from reprocessing materials previously used in construction. Examples include construction and demolition waste material and railway ballast. In the case of this building there is a chance that such material will be available from the demolition of the existing building, and our specifications will allow its use. Close and early coordination with the contractor will be required for this option, as they will need to allow sufficient space for storage.

Secondary aggregates: usually by-products of other industrial processes not previously used in construction. Examples include china clay waste, used foundry sand and metallurgical slags.

Some advantages associated with the use of recycled or secondary aggregates include:

- Reduction of waste to landfill from demolition of the existing building (space is available for stockpiling on site).
- Reduction in energy use.
- Reduction in emissions.
- Reduced drain in natural resources.

One of the major disadvantages with the use of recycled or secondary aggregates is associated with obtaining material, at least in the South East, with the majority of such material being used in road building.

There is also little precedent in the U.K. for the extensive use of recycled aggregates in new structures – any available material is usually used as road sub-base or coarse fill material – however the specification and testing required for its use is relatively straight forward. The use of recycled aggregates also relies on the cooperation of the contractor and concrete suppliers in terms of stockpiling and continuity of supply.

Another factor to consider in the use of recycled or secondary aggregates, especially if exposed concrete soffits (to increase thermal mass) or other surfaces are going to be used, is the colour and finish that will be produced.

4.1.3 Reduction of Portland cement usage

In comparison to some of the difficulties that can be encountered in using recycled or secondary aggregates, the reduction of Portland cement is very straightforward and already quite common.

In terms of CO2 production the impact of cement is much higher than that of the aggregate and incremental increases in efficiency of its use will generally have a greater effect on a building's environmental impact than use of recycled or secondary aggregates. Portland cement replacements are already in common usage in the U.K. (typically in the range of 25-70%), mostly either fly ash (PFA) or ground granulated blast furnace slag (GGBS).

Fly ash: commonly called PFA or pulverised fuel ash, fly ash is a very fine ash by-product from coal-fired power stations that imparts many beneficial properties to concrete.

Ground granulated blast furnace slag: or GGBS is a by-product of the iron-making process and a very consistent material. A slow-setting cement in its own right which needs to be activated and accelerated by the addition of Portland cement, with or without lime. Concrete containing GGBS generally costs no more than the equivalent concrete produced with CEM I PC and costs less than concrete with sulphate resisting Portland cement. GGBS also gives a white/cream colour to the finished concrete that is often desirable when exposed concrete faces are used in a building.

The addition of GGBS provides the following environmental benefits:

- Alleviating the disposal of large amounts of blast furnace slag generated by coal burning power plants and steel mills.
- Helps reduce embodied energy consumption from Portland cement production. Approximately 40% of the embodied energy of concrete can be reduced.
- Reduce damaging pollutants including: CO2, NOX and SO2 and therefore reduce impact on climate change and acid rain.

BREEAM assessment also awards credits for using post-industrial wastes such as PFAs and GGBS under its materials specification criteria.

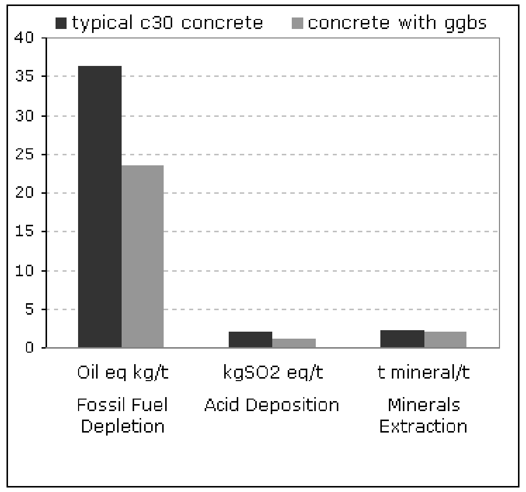


Figure 17: Advantages of GGBS

Modern plasticisers allow for a decreased cement content in concrete and specifications should allow its use so that the maximum practical amount of cementitious additions can be used. Replacing a percentage of the cement with ground granulated blast furnace slag (GGBS) or pulverised fuel ash (PFA) also produces a significantly less permeable concrete with improved resistance to aggressive conditions.

BS 8500 recognises the value of GGBS and PFS in increasing the sulphate resistance of concrete and allows the use of those materials. In addition, these composite cements offer workability and strength advantages through lower water content in the mix and a reduction in early age heat development. This helps to minimise the possibility of thermal cracking.

Our specification will dictate the use of GGBS in the concrete mixes to be adopted for the project.

4.1.4 Structural Steel

Steel construction products are highly recycled and are 100% recyclable using existing technologies; all new steel has a recycled content of between 10 and 100%. The fact that steel construction products can be recycled again and again without any degradation in terms of properties or performance is an important differentiator in construction product selection.

Current global demand for steel exceeds the supply of scrap, necessitation the production of new steel by the BF/BOS steel-making route. While this remains the case, and as construction steel is already nearly 100% recycled, there is no net environmental benefit in specifying a minimum recycled steel content.

For products like metals that are recyclable into new products with the same properties, the end-of-life recycling rate is the more important sustainability indicator and should be used in preference to the recycled content when assessing the credentials of construction materials.

4.2 Construction Practices

The primary consideration in terms of sustainability for construction practices on site is waste minimisation and disposal. Waste disposal costs building projects about 0.4% of the project cost and is set to double within the next 5 years.

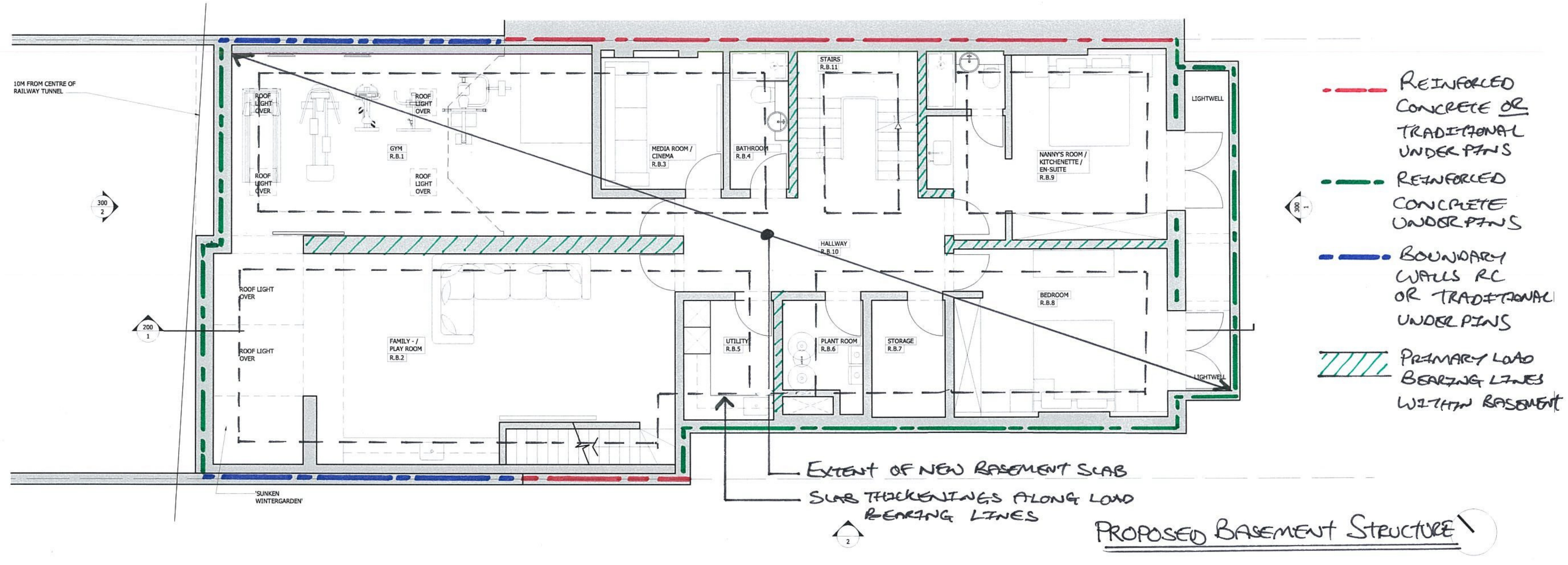
The simplest and most effective way to reduce waste on site is through waste segregation which:

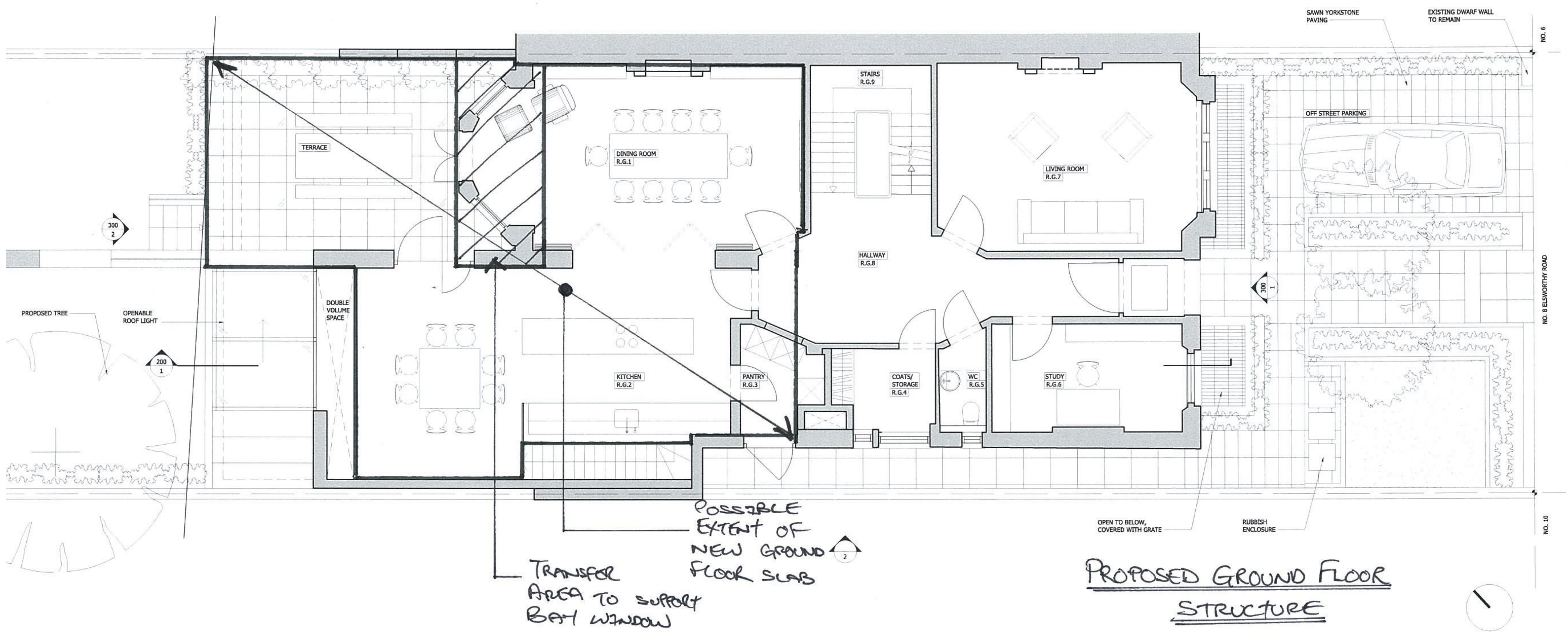
- Encourages the recycling of materials.
- Reduces landfill.
- Saves money.
- Makes sites safer.
- Obtains BREEAM credits.

Contractor's experience where simple waste segregation has been adopted suggests that the amount of waste that needs to be disposed of in landfill is reduced by around 20%, which can equate to cost savings of around 40% on waste disposal.

Empirical evidence also suggests that sites with waste segregation also tend to have more careful storage and handling of materials, re-use of cut-offs and return of unused materials to stockpiles (rather than disposal). This in turn means reduced requirements to over-order and more efficient use of materials. Sites with waste segregation also tend to be cleaner, tidier, and hence safer sites.

It is relatively simple to ensure that waste strategy is included as a tender requirement, and to get waste segregation specified in the contract documents. For very little effort on the part of the contractor this simple measure can have a dramatic impact on the amount of waste that must be sent to landfill.


REINFORCED CONCRETE OR TRADITIONAL UNDERPINS
REINFORCED CONCRETE UNDERPINS
BOUNDARY WALLS RC OR TRADITIONAL UNDERPINS
PRIMARY LOAD BEARING LINES WITHIN BASEMENT
EXTENT OF NEW BASEMENT SLAB
SLAB THICKENINGS ALONG LOAD BEARING LINES
PROPOSED BASEMENT STRUCTURE


POSSIBLE EXTENT OF NEW GROUND FLOOR SLAB
TRANSFER AREA TO SUPPORT BAY WINDOW
PROPOSED GROUND FLOOR STRUCTURE